Compliments

ADDRESS

ON THE

CLASSIFICATION OF SHIPPING,

DELIVERED TO THE

CLYDE SAILING AND STEAMSHIP OWNERS' ASSOCIATIONS
AT GLASGOW, 19TH DECEMBER, 1887.

NATHANIEL DUNLOP, ESQ., IN THE CHAIR.

BY

MR ROBERT DUNCAN,

SHIPBUILDER, PORT-GLASGOW;

REPRESENTATIVE OF THE CLYDE SHIPOWNERS ON THE LOAD LINE COMMITTEE; PAST PRESIDENT AND HON. MEMBER OF COUNCIL OF THE INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND; MEMBER OF THE INSTITUTION OF NAVAL ARCHITECTS, ETC.

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ON THE CLASSIFICATION OF SHIPPING.

HISTORY.

In the "Annals of Lloyd's Register," published for the information of the subscribers in 1884,—the jubilee year of that Society—we find it stated that "although marine insurance is probably as old as maritime commerce, and classification of some kind coeval with them, the first recorded attempt to establish anything like an organised Registry dates back no further than last century, and may be said to have been initiated by Mr Edward Lloyd, at his coffee-house in Lombard Street, where he first published 'Lloyd's News,' in 1696, and in 1726 the world-famous 'Lloyd's Lists,' which continue to this day."

Those earliest ship lists are said "to contain the germs of the Register of Shipping, which came into existence at some period during last century, and which, besides being the first English Classification Society of which there is any record, is the parent of all other Shipping Registries now in existence."

It is further stated that "the oldest copy of a Register of Shipping in the library of Lloyd's Register Office, indeed, so far as can be ascertained, the oldest copy of any book of the kind at present in existence, is dated 1764/65/66, and its singed edges bear evidence of having passed through the flames which laid the Royal Exchange, with all Lloyd's records, in ashes in 1838."

A specimen page of this old volume is given in the "Annals," which shows the information it contains very complete for its time, "an evidence that it was probably not the first of its kind."

The classes there assigned were designated by the vowels—A, E, I, O, U—which referred to the hulls; while G, M, B,—the initial letters of "Good," "Middling," and "Bad,"—related to the equipment.

The next volume in the library is dated 1768/69, and the third is dated 1775/76, and in the latter "for the first time appears the old, familiar class A1."

"There is a very complete collection of volumes from 1775 onward," and the specimen page for 1834, as given in the "Annals,"

the year in which Lloyd's Register Society was re-constituted as it now exists, gives very little more information about the shipping of its day than the records of sixty years before did for the vessels of their time—indeed, not quite so much—for it is interesting to note that in 1775 the "Load Draft" has a column to itself, which seems to have dropped out later on, and is only now beginning to re-appear, more than 100 years after.

We are told that "the form and arrangement of the book, as determined in 1834, remained practically unaltered for many years." The steam engine had not yet materially affected merchant shipping, even the size of vessels had not much increased; the specimen page for 1775 shewing *three* vessels over 400 tons, while the page for 1834 has only *four* over that size.

"In the volume for 1781-82 the first mention is made of Surveyors, although it is apparent that Surveyors were employed before that date, as indicated by the notes of repairs under the vessels' names in the book."

"In the volume for 1797-98 the names of Lloyd's Committee appear for the first time," and that committee consisted of eleven members.

In that year a new style of Classification was introduced that gave great offence to many Shipowners, and led to the starting of a rival Registry in 1799, which was commonly known as the Shipowners' or "Red Book;" the older Registry being known as the Underwriters' or "Green Book." These continued in anything but friendly rivalry till their final amalgamation in 1834, as the reconstituted "Lloyd's Register of British and Foreign Shipping."

It appears that in the opening year of this century, the two societies had Surveyors at 24 ports in England, 4 in Ireland, and 2 in Scotland—Greenock and Leith being the only ports so honoured. Glasgow was not then of sufficient consequence as a shipping port to have a resident Surveyor.

Both societies were conducted very much on the same system. Their books were simply records of the date and place of build, the name and tonnage, the masters and owners, the voyage and class of the vessels entered, with indications of repairs; but by neither society were any fees charged for survey or classification, the whole expense being borne by the subscribers to their respective books. No supervision was exercised over the Shipbuilders or Surveyors. There were no rules for construction, nor for systematic survey, either in building or repairing. Shipbuilders did very much as they pleased as to materials, scantlings, and fastenings; and the Surveyors reported

the construction or repairs, and the Class to which they considered the vessels entitled, to their committees, who entered the facts in their Register Books ; and all was well.

This pleasant state of matters was unhappily too good to last. By 1833 the position of the rival societies "had become so desperate" that they must either amalgamate or collapse. They preferred the former alternative ; and then in 1834, for the first time, began that system of parental authority, which has eventuated in reducing modern shipbuilding to a manufacture, on stereotyped rules and arrangements, over which the Shipbuilder and Shipowner have practically no control.

Dissatisfaction with the composition of the committee, which consisted entirely of London Underwriters, Merchants, and Shipowners, early led to demands from the outports for direct representation, and to the establishing in 1838 of a Liverpool Register of Shipping, which was absorbed by Lloyd's Register in 1845 leaving a branch committee in Liverpool that has been in existence ever since.

In 1844 Lloyd's Register Committee passed a resolution "that the character A1 be granted to vessels built of iron, under survey, of good materials and workmanship; such vessels to be surveyed annually."

The experience gained in this way, during the next ten years, was held sufficient to justify the Society in issuing its first rules for the construction of iron vessels; and it is stated that "the earliest suggested rules for iron vessels of which any record exists were received from the Glasgow office of the Society." With but slight alteration these rules were issued in the following year—1855, the grades of Classification being 12, 9, and 6 years.

From 1845, for nearly twenty years, no change took place in the number or composition of the Committee. Repeated applications from the outports for direct representation received no attention, but in 1862 the starting of the "Liverpool Underwriters' Registry" as an independent Classification Society "for iron vessels only," had the effect of shaking up the Conservatism of the London Register; and in 1864 Lloyd's Committee was increased by ten additional members. Then, for the first time, by direct representation, 15 members were allotted to the outports, out of a General Committee of 41. 4 members were given to Liverpool and 2 to Glasgow. This had to suffice till 1883, when the General Committee was increased to 50 members, by additional representation of the outports. Other 4 members were given to Liverpcol, making 8 in all; besides its Branch Committee of

13 members. The power of Liverpool is thus recognised in Lloyd's Registry by 21 representatives.

At the same time 2 additional members were given to Glasgow, 1 to Greenock, and 1 to Leith, Dundee, and Aberdeen as one district; making 6 members for all Scotland. We shall have something to say about this rather inadequate representation of Scottish interests further on.

In 1864 a request was made from Liverpool that the Chairman of the Liverpool Shipbuilders' Association, who had since 1845 been allowed to hold an *ex-officio* seat on Liverpool Board, should be, *ex-officio*, a member of the General Committee. This was refused as contrary to the constitution of Lloyd's Register.

The Liverpool Underwriters' Registry was started on more liberal principles. One-fourth of its committee were Shipbuilders, and it had a Shipbuilder for Chairman. In consequence of its action and success, rather to the disadvantage of Lloyd's, an entire change was made in 1870 by Lloyd's Register Committee on their system of scantlings and classification for iron vessels, assimilating it, to some extent, to the Liverpool basis and scantlings. From that time Lloyd's Register regained its former prestige; and the amalgamation of the Liverpool Registry with it in 1885 extinguished all opposition in this country, and left Lloyd's Register practically without a rival in the world.

An estimate of its great position may be formed from the statistics in Lloyd's Universal Register for this year. From the returns of the ten principal Classification Societies of the world, Lloyd's included—all of which have come into existence since Lloyd's Register began its great career—it appears that these ten Register Societies have among them about 20 million tons of shipping, and of this amount, Lloyd's proportion is 8½ millions; Bureau Veritas comes next with 4¼ miltions. The Netherlands Register, Norwegian Veritas, and American Record follow in the order named with about 1½ millions each. German Lloyd's is sixth with about 900 thousand tons. The Italian Register, the Austro-Hungarian Veritas, the Register Maritime, and the Greek Veritas divide about one million tons between them, the last having only 60 thousand tons.

Some of this tonnage is necessarily duplicated between Lloyd's and the other Registers when foreign vessels are built here and classed in Lloyd's and their National Registers. More especially is this the case with Bureau Veritas; so that the grand aggregate of classed tonnage may be somewhat less than it appears from the summation of the tonnage of all the Registers; but it is on the whole

near enough to show their respective importance as Classification Societies.

Another point of importance is the proportion of wood and iron tonnage in the respective books. 93½ per cent. of all the tonnage in Lloyd's Register is of iron or steel, the remainder being wood or composite, the latter a very small amount.

The extent to which wooden Shipbuilding or Shipowning still prevails in foreign countries will be evident from the following statement :—While only 6½ per cent. of all Lloyd's classed tonnage is of wood, 41 per cent. of the tonnage of the Netherlands Register is of the same material. The wooden tonnage of Bureau Veritas is 67 per cent. ; of the Italian Register, 73 per cent. ; of the German Lloyds, 77 per cent. ; of the Register Maritime, 78½ per cent. ; of the American Record, 81 per cent. ; of the Austrian Veritas, 92 per cent.; of the Norwegian Veritas, 92½ per cent.; of the Greek Veritas, 100 per cent.; the latter not having a composite, iron, or steel vessel in its books.

From Lloyd's Register Book for this year we learn that only 2,384 tons of wooden vessels were built to class by Lloyd's in 1886; which shows the almost entire cessation of wooden shipbuilding under Lloyd's Registry both at home and abroad.

From the same volume we learn that the tonnage of iron and steel vessels bearing Lloyd's class is as follows :—

	Tons.
British, ...	6,519,644
Colonial, ...	164,777
Foreign, ...	1,290,421
Total Iron and Steel, ...	7,974,842

Of wood and composite vessels classed by Lloyd's, the tonnage is as under :—

	Tons.
British, ...	382,492
Colonial, ...	82,592
Foreign, ...	83,141
Total, wood and composite, ...	548,225

The aggregate of all kinds classed at Lloyd's is :—

	Tons.
British, ...	6,902,136
Colonial, ...	247,369
Foreign, ...	1,373,562
Grand total, ...	8,523,067

It is stated in the Universal Register, that the total tonnage of the world is 20,943,650, and of this the United Kingdom and Colonies possess 10,539,166. Rather more than half of the tonnage of the world flies the British flag; and it will be seen at a glance how large a proportion of this purely British tonnage bears the distinctive marks of Lloyd's Register.

We may here take leave of the Foreign Registers, with the hope that the great British Registry, and the nation that has made it, may be able to maintain in the future that empire of the sea, which, together, they have achieved in the past. And let us express, as we must, our unqualified admiration for this wonderful Association that stands unapproached at the head of the world's shipping, and for the ability and power of organisation which have placed and maintained Lloyd's Register for more than fifty years in this distinguished position.

In the presence of this greatest of the powers that be in Shipping, I am almost afraid even to hint at imperfection in its constitution and its work; but as not even the British Constitution can withstand the changes demanded by time and the reformer, we may venture, without abating in the least our admiration and respect for the gentlemen whose position and work we criticise, to consider for a little one or two points on which it is possible that the government of Lloyd's Register Society may be capable of amendment in constitution and practice.

The first in order, from the Shipbuilder's point of view, and not less in the interest of the Shipowner, is the amendment of the Rules for Scantlings. And the second point, which is probably of greater interest to both parties, is reform of the Constitution; and Representation on the Committee. Bearing on the first point, it is important to remember—

THE OBJECT AND METHODS OF CLASSIFICATION.

The primary object of "Classification," as we all know, is "the security of the Underwriter." That was the origin of Lloyd's Register more than 100 years ago, and of all other Classification Societies since. For that object all these Societies have been maintained and expanded, absorbing all control over the Shipping of the world. If the Underwriter does not feel safe, premiums advance and risks are refused. Few Shipowners can afford to take the whole, or even large risks on their vessels, and it would be a grievous restraint on trade to compel small Shipping investors to risk greater loss with their property than they are liable to in the ordinary

fluctuations of business. Hence the necessity for Classification as a protection to the ordinary Shipowner as well as to the Underwriter.

Large Shipowning Companies, or Lines, that are sufficiently well known, are independent of the Classification Societies. Their reputation is their class, and they may build as they please. Smaller Shipowners must rely for the character of their vessels on the *imprimatur* of the Registries.

Irrespective of the ability of owners to take the entire risks on their vessels, and dispense with Classification, merchants must be satisfied with the underwriting on their cargoes; and in foreign ports where ship and Shipowner are alike unknown, the reputation and remuneration of both depend on the Classification certificate, whatever may be the Shipowner's financial ability to dispense with it. Hence the Underwriter, in the comparatively recent past, with the great development of commerce and shipping of the last fifty years, has been in a position to dictate his own terms for construction and classification, and Shipowners and Shipbuilders had no choice but obey.

Naturally, at the first, and for a considerable time after 1834, there was a good deal of ignorance and inexperience on all hands, especially in the transition from wood to iron shipbuilding. Timber of all kinds varied greatly in quality and durability, hence wooden vessels were properly classed for terms of years, according to the quality and arrangement of the timber of which they were built, and to the quantity and arrangement of iron, brass, and copper fastenings by which the various timbers were bound together.

With iron vessels the homogeneous character of the material obviated all difficulty on the score of durability, except in so far as the thinness of the scantling might be affected by corrosion; hence it was early seen that the terms of years that were appropriate enough in the classification of wooden vessels, were inappropriate for iron vessels. The Liverpool Registry broke the record in 1862 with their 20 years' grade, and compelled Lloyd's Register in 1870 to abandon the yearly grades for the present 100 A and other standards of unlimited duration, subject only to periodic survey.

This change in the terms and symbols of Classification was accompanied by an even more important change in the scantlings and arrangement of material in iron vessels; and in the basis upon which the amount and distribution of this material in construction was determined, as well as in the amount and quality of the workmanship required to be expended on it.

BASIS OF LLOYD'S RULES FOR CONSTRUCTION.

Tonnage was the principal basis for the regulation of scantlings by all Register Societies till 1862, when the Liverpool Underwriters' Registry introduced the system of apportioning scantlings by linear dimensions. Tonnage continued to be the regulating standard of Lloyd's Register for all vessels until 1870, and is still their regulating standard for wooden and composite vessels.

The chief reason assigned for the change in 1870 from tonnage to "numerals," which has since been the regulating standard for iron and steel vessels, was, that as the scantlings had been made to depend on a tonnage measured and calculated after the vessels were completed, by an authority outside of the Register, and over which they had no control, it frequently happened that vessels built to the limit of one tonnage grade, were found upon measurement to have overstepped that grade, and very great trouble was in consequence occasioned to builders, owners, and the Registry, for which there was no redress. This is naturally the case with all hard and fast lines in two hands, but it will be obvious that the same objection would apply, and the same troubles arise, with any system of apportioning scantlings, which involved measurement of the vessel during construction, or after completion, even by the Society's Surveyors alone; and it was doubtless felt that unless the Shipbuilders' plans and calculations could be relied on for measurement before the work was begun, some simpler method, like the Liverpool system, was the only alternative.

That the evils of the tonnage system were not very serious, will be manifest from the fact that under it the range between the grades below 1,000 tons was only 100 tons; and above 1,000 tons nowhere exceeded 500 tons.

The ranges were undeniably narrow in the lower grades, although sufficiently wide in the higher. Any difference at all below 1,000 tons could scarcely be less than 100 tons, and as the majority of the vessels of that period were under 1,000 tons, they had to be built to the upper limits of their grades to get the full benefit of the change of scantlings. As a natural consequence, mistakes and overstepping were not uncommon where the margin was so small, and Government official measurers, as well as Lloyd's, inflexible.

This reason was probably considered sufficient for the very great change from "Tonnage" to "Numerals;" but it is hardly too much to say, that from being too narrow, the "Numeral" grades, although

probably intended to give identical results with the superseded tonnage grades, were found in practice to be so very wide, as respects tonnage and displacement, that it is scarcely possible to make any tonnage too large to go through them, and almost equally impossible, with ordinary attention, to overstep the grading lines.

The Liverpool system had accustomed Shipbuilders and Shipowners to the manipulation of form and scantlings on a dimensions basis; and, with the numeral system of Lloyd's, they soon learned to select the proportions and dimensions which promised the largest capacity—dead-weight and measurement—with the least material in the ship itself; and the tonnage being no longer any check upon scantlings, the shapes of modern cargo carriers became remarkable for the success with which the squarest forms that could be driven through the water at the lowest commercially profitable speed were evolved from Lloyd's new rules.

That it was not Mr Waymouth's intention in the framing of the "Numeral System" to encourage abnormal forms, but rather the reverse, will be evident from the fact of his importing the half-girth of the midship section into the formula for scantlings. The underlying idea of the half-girth was probably the old belief that had dominated the designs of vessels till that time, namely—"That the form of a vessel (now expressed in co-efficients of tonnage) might be held to be the exact equivalent of the rise of floor." I need scarcely say that this idea or belief no longer holds any place in the Shipbuilder's estimate of the necessities of form. Thanks chiefly to the experimental investigations of the late Mr Froude, it has been satisfactorily demonstrated that the breadth, shape, and area of the midship section have little or no influence on speed; the midship section has therefore been dropped out of consideration by Shipbuilders, further than in its effect upon Lloyd's numerals for scantlings.

In this respect it not unfrequently defeats the end intended, which is assumed to be—"Midship's strength in relation to length of vessel and the loaded stress the material in the midship section may have to bear."

With vessels of guaranteed dead weight carrying capacity, where the load displacement is a fixed quantity, the breadth may be minimised and the half girth reduced by rounding the bilge, both to the extreme limit of instability—as has been sadly illustrated in the lists of missing and foundered—all to save a numeral and secure lighter scantlings; while the load so removed from the middle has been transferred to the two ends, on the form of which there is no

restriction. Hence the lighter midship scantlings are penalised by weight in the wrong place, both for strength and seaworthiness.

All scientific naval architects know, and none know better than the distinguished chiefs of Lloyd's Register, that it would be an advantage to the ship in increased strength, stability, and speed, to be able to remove the weight and fulness from the ends to the middle, by increasing the breadth and area of the midship section without increasing the displacement, and, if it were possible, without increasing the scantlings and weight of the ship itself; but, unfortunately, we all know, and none know better than the gentlemen referred to, that this is practically impossible under the numeral system. The shape of the ship beyond the middle is independent of the formulæ for scantlings. The middle is bound by breadth, half breadth, and half girth in rigid bonds, from which there is no escape; while the ends may play all the fantastic tricks in shape and sheer with which we have become familiar.

If, on the other hand, we have room enough in the middle, within the numerals, for our load displacement, to any degree of fineness we may require for speed, no consideration is given in the scantlings for any removal of the weight from the ends, and consequent diminution of stress on the material of the midship section. With the same dimensions and midship section, no alteration of a single figure of the numerals or scantlings is necessary to vary the form of the vessel through the entire range of co-efficients usual in merchant shipbuilding, from ·50 to ·85; with all the variations in tonnage, displacement, load, and strength, these figures represent.

As the scantlings are apportioned to the heaviest strains that can be brought to bear on vessels of the fullest forms, designed to the upper limits of the respective grades, the strength requirements of the rules become oppressive on all the finer forms in various ways.

Firstly, by being burdened with a weight and strength of scantlings sufficient for double or treble their load displacement.

Secondly, by the consequent greater first cost of the vessel itself and the power required to drive it.

Thirdly, in that the extra weight where the draft of water is limited necessitates greater length and breadth, and consequently increased scantlings, with still greater weight, displacement, and power, than would be required were the scantlings equitably proportioned to their work.

The action and re-action of these excesses, continually add to the size and cost, without in any respect adding to the efficiency of the vessel, or of the service for which it may be required.

THE REMEDY—A DISPLACEMENT BASIS.

The remedy for this is simple, and involves no change of principle in Lloyd's Rules. "Let the dimensions and load line displacement, together determine the form, strength, and scantlings, for the work required."

Strength in relation to length of vessel, and load, is already the fundamental principle of Lloyd's Rules and Tables of Scantlings for iron and steel vessels. It is also the fundamental principle of the Freeboard Rules and Tables first put forward by Mr Martell, the eminent Chief Surveyor of Lloyd's Registry, and, with certain modifications—including a more explicit recognition of the principle of "strength in relation to length and load"—approved by the Load Line Committee, accepted by the Board of Trade, and again transferred to Lloyd's Register Committee for administration. Doubtless Lloyd's accepted all the conditions, expressed and implied, in the Report and Rules of the Load Line Committee. We may therefore assume that the old objection, that "a load line must first be determined before a displacement base can be adopted," is now obviated. And with the recommendation of the Load Line Committee, and of the Royal Commission on Loss of Life at Sea, this Load Line is not unlikely to receive Parliamentary enactment, and international adoption.

The Load Line Committee attached three conditions to their Report and Rules, with which the Administrative Authority would require to comply.

The first is that the Freeboard of vessels not classed by Lloyd's shall be determined by their *strength* in relation to the types of Lloyd's classed vessels to which they may belong.

Secondly, that vessels of Lloyd's class of the spar and awning deck types may have their Freeboard reduced or increased as their strength is increased or reduced above or below the standard of their respective types.

Thirdly, "that this strength shall be determined by the limit at which the stress per square inch, upon the material of the hull amidships, shall not exceed that of the Standard Class, of the same proportions, form, and moulded depth, when loaded to the freeboards assigned" by the respective rules and tables.

The point in these conditions which the Load Line Committee did not feel themselves in a position to determine more exactly, is the formula or factor by which this stress upon the midship section is to be ascertained. They were well aware that the stress factor for Lloyd's first-class ships was not an uniform quantity, but varied greatly

with the size of the vessel as respects dimensions, and with the form and load, on all dimensions; hence they declared that "to the responsible authorities a large discretion must be allowed in applying the tables with reasonable modifications" from time to time; adding, "We are well aware that the discretion which we thus regard as necessary, is such as should be exercised with very great skill, care, and judgment; but we see no reason why those charged with the responsible duty of preventing the overloading of merchant ships, should not have at their command all needful assistance."

That Lloyd's Register Committee have at their command all needful assistance is unquestionable; the point involved for the consideration of Shipowners who do not class at Lloyd's, as well as for those who do, but who require other forms than the full-bodied, low-speed types for which Lloyd's Rules alone provide:—and all Shipbuilders, as well as Shipowners, are more or less interested in this question:—is, "What is the Standard by which vessels of fine form, with scantling arrangements that do not conform to Lloyd's Rules, are to be judged?"

It requires no great stretch of imagination to feel assured that with any other competent administrative authority than Lloyd's, the relation between the strength of fine and full-formed vessels would probably be equitably treated; but, with Lloyd's Register Committee as the administrative body, under their own rules, in competition or comparison with other people's rules, or arrangements of scantlings for strength, it is just possible that finely formed vessels with unorthodox scantlings, would receive slight consideration. Hence, in view of Lloyd's Register Committee being confirmed as the administrative body for the Load Line, it is not unreasonable to ask them to define their standard of strength for each respective grade, so that all vessels of the same grade, and irrespective of form, shall have the same measure of strength in relation to their load displacement, dimensions, and proportions, as every other on the same dimensions within the respective grades.

In this way alone will it be possible for Shipbuilders and Shipowners, who desire to build vessels for specific purposes on specific load lines, and on other scantlings and rules than those of Lloyd's Register, and of other forms than the fullest, be able to know by comparison, with any measure of probability, what they have to do to ensure sufficient strength for the work they intend their vessels to perform on the statutory "Freeboard," or any greater freeboard they may prefer.

The sum of the argument in favour of a displacement basis for

scantlings, with a strength factor for each grade, is, that the "Load Displacement" determines absolutely the weight of the ship, for which strength has to be provided,—with all its deck erections, irrespective of their size or tonnage or the purpose for which they have been erected; with the machinery and entire equipment; and with the coal and cargo with which it can be loaded to the specific freeboard, either for safety or strength;—while the "Length of the Ship" determines with equal certainty the limit of the distribution of that weight for the necessary strength to carry it.

The only doubtful point in respect to distribution, is that while a fixed load displacement is the measure of the form of every ship, the distribution of weight varies with the arrangement of the weights of the ship itself—of its superstructure, equipment, and machinery—as fixed elements, and of the coal and cargo as varying elements, and with each new cargo; hence the measure of strength, or factor of safety, must make sufficient allowance for irregularities in this direction, which, as respects the cargo only, cannot be calculated with certainty.

The absolute certainty on this basis consists in the fixed character of the Load Line displacement, which, according to the form of the vessel, can never be altered.

The absolutely exact ratio between the co-efficients of under deck tonnage and displacement, was proved to the satisfaction of the Load Line Committee by Mr Martell, Mr William Denny, and myself, so that the correctness of a load displacement base is incontrovertible, and the check by under deck tonnage inevitable, while the ignorant or intentional overstepping of the grades, which the tonnage check would expose, could be met by the simple penalty of a corresponding increase of freeboard to equalise the strength. Another absolute certainty is "the greater cargo strains under storm conditions, of full-bodied vessels which carry their loads with comparatively little diminution to their extremities." The "pitching" and "ascending," "rolling" and "twisting" motions of such vessels in heavy seas, are always relatively more severe than in finer ended vessels, because of their greater load and greater displacement at the bow and stern; so that the stress on the material of the midship section of a full-bodied vessel of the co-efficient ·80 type is in point of fact, as well as by calculation, at least twice as great as it is in the midship section of a co-efficient ·50 vessel of the same dimensions and scantlings, at their respective load lines. Hence factors for strength ought to be greatest for the fullest forms in ratio

to their length; but inasmuch as the finer forms for higher speeds have greater driving strains to contend with—in the panting and vibrating of their ends—which require to be otherwise provided for, it need not be disputed that an uniform factor in ratio to length and load, determined by the strength presently found sufficient for the fullest form in each grade, would give an ample margin for all other strains on other forms within the grades.

There are sufficient and well understood reasons why small vessels should be relatively stronger than large vessels—measured by the factor of stress upon their midship sections—but there scarcely seems reason enough why vessels of 200 tons should require to be four times as strong as vessels of 2,000 tons. Nevertheless, with a fair factor of strength for each grade of displacement, according to length, justice as between ship and ship would probably be satisfied.

It need hardly be repeated here, that every saving in weight of hull without diminution of strength, is of value to the Shipowner, not only in the smaller first cost, but in the weight saved being available for freight earning cargo, or for greater power with increased speed, or for reducing the size of vessel for the same cargo, or for other reasons, which Shipowners are equally capable of estimating and appreciating. This is the main reason for the great development of steel shipbuilding within recent years. The same remark applies to machinery. Increased power from lighter weights is the order of the day. Steel castings, forgings, and boilers; higher pressures, and quicker piston speed, evolving the largest power out of the smallest weight of machinery, and with the least consumption of fuel; each and every improvement promoting all round economy, with greatly increased efficiency. All these things are necessary to enable us to hold our own against foreign competition; and it is certainly the interest of the Shipowners, and the duty of Lloyd's Register, as the greatest representative interest of the Shipowners in this country, to see that every ton of material used in the construction of ships and machinery, is doing useful work and a fair proportion of that work, instead of adding unnecessarily to the costly and unremunerative load.

REFORM IN THE CONSTITUTION AND REPRESENTATION OF LLOYD'S REGISTER.

Coming now to the second point in our "Reform Bill," without which the first will probably stand an indifferent chance of receiving much attention, it is desirable in the interest of the Shipowners and

Shipbuilders of Britain, that there should be a revision of the Constitution of Lloyd's Register Society, and in the representation of the principal shipowning and shipbuilding ports, upon the Committee.

At present, Shipbuilders are not recognised by the Constitution as having either rights, privileges, or interests, in the affairs of the Society, or in their own business. Possibly this may have been due to the fact that at the time of the framing of the Constitution, the Shipbuilders were entirely independent of the Registry, and acknowledged as such, by the London Underwriters, Merchants and Shipowners, who then reorganised it.

It need hardly be said that the subsequent assumption by Lloyd's Register Committee of the entire control of the shipbuilding of the country has totally altered the conditions of the respective interests represented and affected by it.

Shipbuilders from being independent have become the humble servants of the Society, with a very small voice in the construction of the vessels they build.

I doubt if the Underwriters, Merchants, and Shipowners, who framed the constitution, foresaw or intended this result; or if any of them at the present day would be disposed to attempt a justification of this unrepresented exclusion of the great interest they so entirely control.

There are gentlemen now on Lloyd's Committee as Shipowners, Merchants, and Underwriters who are Shipbuilders first, and whose presence as Shipbuilders is a distinct gain to the Committee.

With the utmost respect for the Underwriters and Merchants, who compose two-thirds of the Committee, the question may be asked—Have they any knowledge of the technical details of their administration?

As Shipowners, if they are also Shipowners, no one will dispute their knowledge, because it is an important part of their business to know something of the constructive details of the vessels they own; but with the practical and scientific reasons for these details, probably few Shipowners even are familiar. The Shipowners on Lloyd's Register Committee know that the scantlings and arrangement rules of their Society are the result of great experience and scientific skill, and as such are taken on trust by the non-technical members of the Committee and legislated for accordingly.

Science of all kinds nowadays—as well as trade and commerce—has become the business of specialists, and it is no disparagement to the non-technical members of Lloyd's Committee, that they feel themselves obliged to rely to a great extent on their few technical

members and permanent scientific staff. Let it at once be admitted—as it will be by all who know them—that the gentlemen who constitute the principal executive of Lloyd's Register are unsurpassed in their technical and scientific knowledge of naval architecture; but it is impossible for them to forget that they are the responsible advisers of the Committee of the most important shipping organisation in the world; and that it is not their duty—as it is not their interest—to initiate changes in the rules and administration of their Society, until the inexorable logic of necessity compels them.

I feel sure that those gentlemen would not be likely to object to an addition to the Committee of practical and scientific Shipbuilders and Engineers, whose special knowledge would relieve them from their present heavy burden of undivided responsibility, and support them in any measure that would be for the general benefit of all the interests controlled by their great organization.

Let me add, in a word, that no objection could be taken to the admission on the Committee of representatives from the Institution of Naval Architects in London; from the Institution of Engineers and Shipbuilders in Scotland; and from the younger, but not less important Institution of Engineers and Shipbuilders of the North-East Coast of England. The interests these Institutions represent are recognised by the world at large as not second to any in this this great maritime country.

Passing from the debatable ground of a change of constitution to the safer platform of the rights presently within it, I have been at some pains to look into the matter of more equitable representation on the Committee from the Shipowners' point of view—more especially as concerns the representation of the Clyde and Scotland.

For this purpose I have analysed Lloyd's Register Book for this present year, extracting the number and tonnage of all the vessels belonging to the respective ports represented on Lloyd's Register Committee—not merely the port of Registry—many vessels are registered where they are neither owned nor managed—but taking the list of ownership in the book, giving each port the credit of all shipping standing in the names of the owners or managers in that port. *e. g.*—The P. & O. registered where built, and the British India and the Castle Line chiefly Scotch, all managed in London.

As a basis of comparison, I have taken the total British tonnage classed at Lloyd's, as given in the statistical table of the same book. Also, the present number of members of Committee, to be divided, in proportion to tonnage, among the ports presently represented.

The following is the tabulated result:—

TOTAL BRITISH TONNAGE CLASSED IN LLOYD'S REGISTER BOOK, 1887-8.

6566 VESSELS OF 6,902,136 TONS.

Vessels Belonging to	Gross.		Classed.		Per Centage of Total British Classed Tonnage.	Present Representation on Lloyd's Committee of Fifty.	Proportion of Representation to Tonnage Classed.
	No.	Tonnage.	No.	Tonnage.			
LONDON	1690	2,210,501	1165	1,677,731	24·33	26	12·17
LIVERPOOL	1611	2,099,843	1077	1,535,445	22·24	8	11·12
					Branch Committee	13 } 21	
TYNE, WEAR, TEES	1316	1,509,741	1005	1,404,627	20·35	7	10·17
GLASGOW to GREENOCK	1244	1,389,841	800	1,092,338	15·82	5	7·91
ABERDEEN, DUNDEE, LEITH	396	358,976	311	325,959	4·72	1	2·36
CARDIFF, NEWPORT, SWANSEA	422	359,473	343	332,158	4·81	1	2·40
HULL	326	240,624	277	232,673	3·37	1	1·68
BRISTOL	87	58,564	42	38,886	·56	1	·28
Total	7092	8,227,563	5020	6,639,817	96·20	50	48·09
			SCOTLAND'S TONNAGE AND REPRESENTATION.			*Is*	*Should be*
	1640	1,748,817	1111	1,418,297	20·54	6	10·27

It will be observed that the eleven principal ports or districts shewn in the table hold among them 96·2 per cent. of the total classed tonnage owned in Britain.

London's share of that tonnage is 24·33 per cent., and its representation on Lloyd's Register Committee is 52 per cent., or 26 members. If represented in proportion to its shipping, it should have only 12 members; but, crediting it as the principal port, and the headquarters of the Society, with the 2 members due to the 3·8 per cent. of classed British shipping owned in other places than the represented ports, its maximum representation would be 14 members instead of 26.

It will probably be contended that London, as the port of origin of the Society, and the metropolitan representative of British interests everywhere, is entitled to represent the Colonial and Foreign Shipping classed at Lloyd's. London's right to all honour and priority on the ground stated is not disputed, but the contention can hardly be maintained that the Merchants and Shipowners of London, who elect two-thirds of London's representatives on Lloyd's Committee, have a greater interest in the Colonial and Foreign vessels classed by the Society than the Merchants and Shipowners of the rest of the United Kingdom.

The total Colonial tonnage classed at Lloyd's is only 333 vessels of 247,369 tons, and the whole of it would barely entitle the Colonies to 2 representatives.

The Foreign Shipping classed at Lloyd's is 1080 vessels of 1,373,562 tons, but this cannot be acknowledged as a British interest at all, much less as a peculiarly London one. Most of the foreign vessels built in Britain, or built to Lloyd's class abroad, are of iron or steel, classed for the scantlings and survey chiefly, and frequently in association with Bureau Veritas, or other first-class Continental Registry, to satisfy the nationality of the owners. London has therefore no right to a monopoly of that interest to the exclusion of the other ports represented on the Committee. All are entitled to share alike in the Colonial and Foreign interests in the proportion of their British interests in the Society.

As respects Scotland's right to additional representation—the Scottish ports presently represented are entitled to 10 members, instead of 6. But, in addition to the shipowning interests of Scotland, the Clyde has a special claim to representation as the greatest shipbuilding centre in the world.

According to Lloyd's Register, 399,711 tons of shipping were built in the United Kingdom last year, of which Lloyd's classed

371,908 tons. For the details of this shipbuilding, we have to apply to the statistics of the Board of Trade for 1886, and under the heading of "Total Number and Net Tonnage of Sailing Vessels, and Gross Tonnage of Steam Vessels, built at each Port in the United Kingdom in 1886, exclusive of Vessels built for Foreigners, and War Vessels," we find that

				Tons.
London	built	45	Vessels, ... =	3,696
Liverpool	,,	16	,, ... =	18,268
The Tyne	,,	50	,, ... =	49,614
The Wear	,,	28	,, ... =	46,187
The Tees	,,	18	,, ... =	33,797
Total,		157	,, ... =	151,162

While the Clyde between Glasgow and Greenock built 151 vessels, of 135,159 tons.

Please note that the five shipbuilding districts of England above enumerated return 41 members to Lloyd's Register Committee of 50, Liverpool having in addition, as already stated, a Branch Committee of 13 members. This makes a total representation of 54 members for these ports on and directly influencing the administration of Lloyd's Register Committee, while the Clyde has only 5.

The Clyde, which owns 1/6th of the total British tonnage classed in Lloyd's Register, and which builds 6 times the British merchant tonnage of London and Liverpool combined, has about 1/7th of their joint representation on Lloyd's Register Committee, and less than 1/9th of the combined London and Liverpool Committees of Lloyd's Register.

It need scarcely be said that there is matter here for serious reflection on the part of the Shipowners and Shipbuilders of Scotland, and I might add also, for our friends of the Tyne, Wear, and Tees. They equal the Scottish ports in the tonnage owned among them, and in their aggregate shipbuilding.

Between them and us, we build nearly all the shipping of Great Britain and of the Colonies and foreign countries who favour British shipbuilding. Between them and us we own 40 per cent. of all the tonnage classed in Lloyd's Register Book, yet as Shipbuilders we have not a voice in its construction, and as Shipowners, Merchants, and Underwriters, not the fourth part of its representation on the Committee of Lloyd's Register.

For Scotland, the case is peculiar; much of our shipbuilding comes from England, as well as from the Colonies and foreign countries, and not a little of it from our compatriots resident in

England and abroad, for whose shipowning enterprise England naturally gets credit.

In respect of shipbuilding, London and Liverpool are nowhere in comparison with Scotland; and in shipowning, we are not far short of either. Is it not time therefore that the north country Shipowners and Shipbuilders should respectfully invite Lloyd's Register Committee to consider a revision of their constitution and representation.

Possibly it might be said on behalf of Scotland that a Branch Committee, on the lines of Liverpool, would suit us better than additional representation in London. The honour of a seat at the London Board is counterbalanced by the inability of our representatives to attend the weekly meetings of the Committee, or indeed oftener than once a month, or three or four times in a year. In this way much of the value of their services is lost to their constituents, while all their time and collective wisdom would be utilised on a local committee with properly delegated powers.

It is for you, gentlemen, as the representative Shipowners of Scotland, in conjunction with the Shipowners of the North of England, to take the necessary action to have your representation rectified; and, I think, I may venture to add, on behalf of the Shipbuilders and Engineers of Scotland and the North of England, and on behalf of the three great institutions I have named as representing the Science and Art of Naval Architecture and Marine Engineering in Great Britain, that you may count upon their hearty co-operation—as they would earnestly solicit yours—to amend your representation, and to remove from the constitution of Lloyd's Register the slur that presently rests on the unrepresented heads of the greatest Shipbuilding and Engineering interests in the world.